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Notes on distribution and taxonomy of five poorly known species of pinnotherid crabs from the eastern Pacific (Crustacea: Brachyura: Pinnotheridae)

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Abstract.—The Pinnotherid crabs *Glassella costaricana* (Wicksten, 1982) [from Costa Rica], *Pinnixa richardsoni* (Glassell, 1936) [from Panama] and *P. scamit* Martin & Zmarzly, 1994 [from California, U.S.A.] are reported for the first time from the Mexican Pacific. They were collected at Acapulco, Guerrero, Juchitán de Zaragoza, Oaxaca, and Todos Santos Bay, Baja California, respectively. The southern distribution of *P. barnharti* Rathbun, 1918 is found to be restricted to Punta Banda estuary, Todos Santos Bay, Baja California, Mexico. A second male of *Pinnaxodes gigas* Green, 1992, is reported from the upper Gulf of California; its range is extended from Estero Tastiota, Sonora to Bajo Macho, northeast Consag Rock. Based on the new material taxonomic remarks on the species are provided.

The distribution of five poorly known species of symbiotic crabs of the family Pinnotheridae is updated based on new material collected on the west coast of Mexico. *Glassella costaricana* (Wicksten 1982), *Pinnixa richardsoni* Glassell 1936, and *Pinnixa scamit* Martin & Zmarzly, 1994, are recorded for the first time in Mexican waters. The new records extend the distribution of those reported by Zmarzly (1992), Martin & Zmarzly (1994) and Hendrickx (1995). The southern distribution of *Pinnixa barnharti* is found to be restricted to Punta Banda estuary, Todos Santos Bay, Baja California, and the distribution of *Pinnaxodes gigas* is extended from Tastiota estuary, Sonora, to Bajo Macho, NE of Consag Rock, in the upper Gulf of California. For each species, taxonomic remarks based on the new material are provided.

The new material has been compared with specimens deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM); Natural History Museum of Los Angeles County, Los Angeles, California (formerly Allan Hancock Foundation, University of Southern California, Los Angeles, California) (LACM); Colección de Equinodermos (CE) and Colección de Macroinvertebrados Bentónicos (EMU), Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México. The new material is deposited in the Colección de Invertebrados, Facultad de Ciencias, Universidad Autónoma de Baja California (UABC). Abbreviations used are: Gulf of California (GC); Baja California (BC); Baja California Sur (BCS); Sonora (SON); walking legs (WL); third maxilliped (MXP3).

Systematic Account

Glassella costaricana (Wicksten, 1982) Fig. 1A

Pinnixa costaricana Wicksten, 1982:579–582, figs. 1, 2A–D; Hendrickx, 1995: 148.

Glassella costaricana: Campos & Wicksten, 1997:69–73, figs. 1, 2A–D.

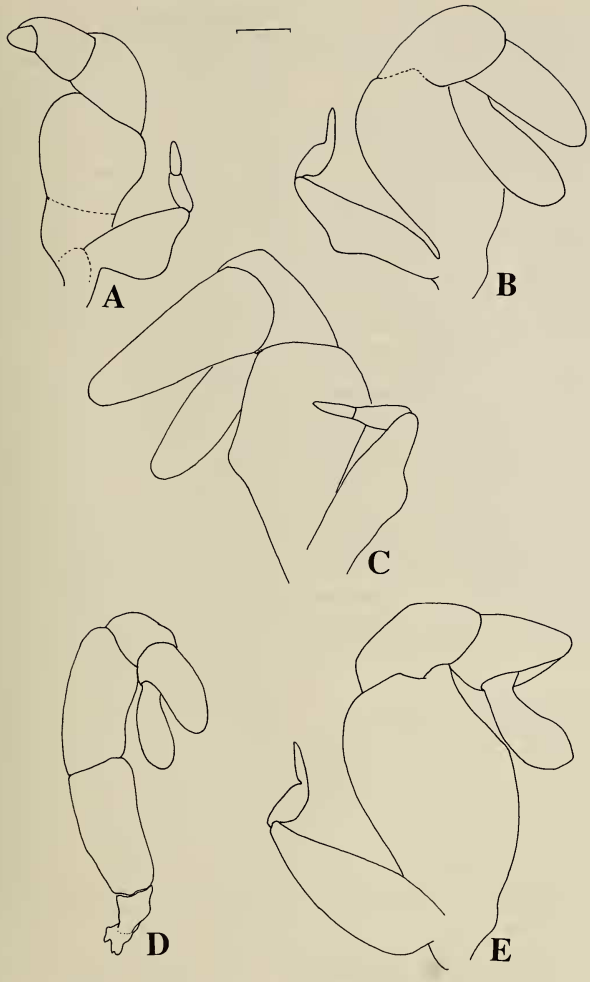

Fig. 1. Third maxilliped. A, *Pinnixa scamit* Martin & Zmarzly, 1994; B, *Pinnixa barnharti* Rathbun, 1918; C, *Scleroplax granulata* Rathbun, 1893; D, *Alarconia seaholmi* Glassell, 1936: E, *Holothuriophilus* sp. (A, from Martin & Zmarzly 1994; D, from Glassell 1936). Not to scale.

Previous distribution.—Playa de Coco, Guanacaste province, Costa Rica (about 10°5′N, 85°45′W); low intertidal zone, sand and rocks (type locality).

Material examined.—1 female holotype (LACM 2252-17); 1 female, Manzanillo Beach, Acapulco, Guerrero, Mexico, 4 Aug 1988 (UABC). Host unknown.

Remarks.—The singular shape of MXP3 allows separation of *G. costaricana* from American species with a *Pinnixa*-like morphology. These species have a wider than long carapace, firm or hard, and the third pair of walking legs are the longest. The MXP3 in *Glassella costaricana* has a pyriform ischium-merus. Moreover, the palp of this appendage has a carpus larger than the conical propodus and a small, digitiform dactylus inserted subdistally on the inner face of the propodus (Fig. 1A). *Pinnixa* spp., *Scleroplax granulata* Rathbun, 1893 and *Alarconia seaholmi* Glassell, 1938, in contrast, have a subtrapezoidal or subrectangular ischium-merus (in the latter species these articles are well-separated). Furthermore, the palp has a carpus shorter than the spatulated propodus and, a large and spatulate dactylus inserted on the proximal ventral margin of the propodus (Fig. 1B–D).

Pinnaxodes gigas Green, 1992
Figs. 2A–B, 3A–B

Pinnaxodes gigas Green, 1992:775–779, figs. 1, 2A–B, 3A–F; Hendrickx, 1995: 141 (listed).

Previous distribution.—Morro Colorado (Tastiota estuary), SON, Mexico.

Material examined.—1 male, Bajo Macho, northeast of Consag Rock, upper Gulf of California, Mexico, May 1995 (UABC); shrimp trawl.

Remarks.—Green (1992) pointed out that *P. gigas* resembles the Atlantic species *P. floridensis* Wells & Wells, 1961. Males of these species are also morphologically similar to males of the Pacific species *Opisthopus transversus* Rathbun, 1918. These species share a suborbicular carapace, a MXP3 with a spoon-shaped dactylus proximally inserted on the spatulate propodus, and a narrow and triangular abdomen (Figs. 2A–F; 3A, C, E). However, morphological differences between the former two species and *O. transversus* do exist, including shape of the front, meri of WL, and telson. *Pinnaxodes gigas* and *P. floridensis* have the front entire (Fig. 2A, C), meri of WL distally swollen (Fig. 3B, D) and telson basally expanded (Fig. 3A, C). *Opisthopus transversus,* in contrast, has the front emarginated (Fig. 2A), meri of WL uniformly wide (Fig. 3F), and telson not basally expanded (Fig. 3E).

Regarding the taxonomic status of the monotypic genus *Opisthopus* Rathbun, 1893, Rathbun (1918) noted that perhaps this genus should be united with *Pinnaxodes* Heller, 1865. The shared features here recorded among *O. transversus, P. gigas* and *P. floridensis,* seem to support this unification. However, we prefer to maintain *Opisthopus* separated from *Pinnaxodes* until an ongoing systematic revision of the pinnotheird crabs symbiotic with sea cucumbers is completed by the senior author.

Hopkins & Scatland (1964) reported that *O. transversus* develops a bright-red mottling on the carapace when harbored in the cloaca of holothurids. This is due to the crab eating mud rich in carotenoids from the cloaca of its host. Wells & Wells (1961) and Green (1992) reported the same red spots on *P. floridensis* and *P. gigas.* The dry male recorded here, features red-orange spots on the carapace as well. The hypothesis is that *P. gigas* is a symbiont of holothurids, capable of leaving its host temporarily perhaps in search of a solitary female harbored in the cloaca of another host.

Pinnixa barnharti Rathbun, 1918
Fig. 1B

Pinnixa barnharti Rathbun, 1918: 130, 144, 149, 150. pl. 32, fig. 1; Schmitt, McCain, & Davidson, 1973:103; Garth & Abbott,

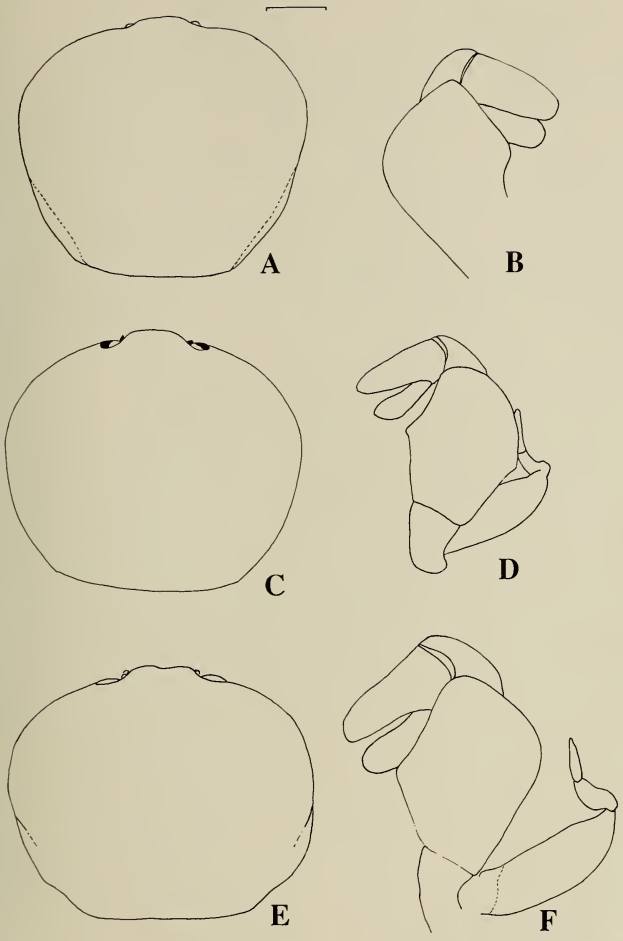

Fig. 2. *Pinnaxodes gigas* Green, 1992: A, carapace; B, third maxilliped. *P. floridensis* Wells & Wells, 1961: C, carapace; D, third maxilliped. *Opisthopus transversus* Rathbun, 1893; E, caparace; F, third maxilliped. Scale (mm), A = 3.4; B = 0.87; C = 1.45; D = 0.4; E = 1.27, F = 0.36.

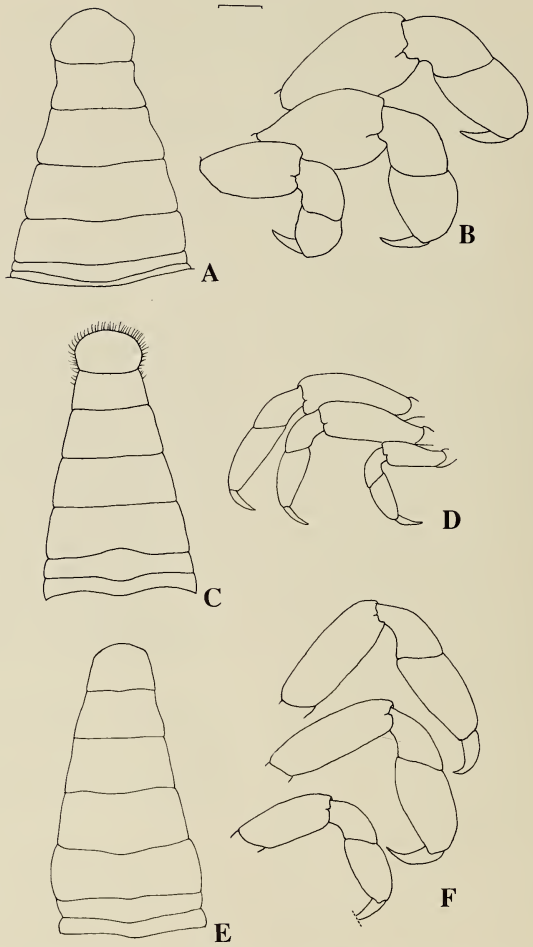

Fig. 3. *Pinnaxodes gigas* Green, 1992: A, abdomen; B, walking legs 2–4. *P. floridensis* Wells & Wells, 1961: C, abdomen; D, walking legs 2–4. *Opisthopus transversus* Rathbun, 1893: E, abdomen; F, walking legs 2–4. Scale (mm), A = 1.46; B = 2.17; C = 1.18; D = 1.52; E = 0.73; F = 1.27.

1980:614; Ricketts, Calvin & Hedgpeth, 1985:338; Bonfil, Carvacho & Campos, 1992:47–48; Zmarzly, 1992:679–682, figs. 2, 3; Hendrickx, 1995:141 (listed).

Previous distribution.—From Puget Sound, Washington, U.S.A., to Punta Banda estuary, Todos Santos Bay, Ensenada, BC, Mexico; Ixtapa Island, Zihuatanejo, Guerrero, Mexico (Zmarzly 1992).

Material examined.—2 females, Punta Banda estuary, Todos Santos Bay, Ensenada, BC, Mexico, 24 Jun 1935, LACM 35-189-1; 1 male, same locality, 24 Feb 1995; infesting the holothurid *Caudina arenicola* (Stimpson, 1857), UABC.

Remarks.—Caso (1965) reported *Pinnixa barnharti* to Ixtapa island, Zihuatanejo, Guerrero, Mexico in *Paraholothuria riojai* Caso, 1964. One of us (EC) studied the crab specimen on which Caso based her report (CE uncat), and it actually is a species of the genus *Holothuriophilus* Nauck, 1880. Manning (1993) discussed the taxonomy of this genus. Typical members of the *Pinnixa*-complex differ from *Holothuriophilus* by the enlargement of the third pair of walking legs. In *P. barnharti,* that leg is not notoriously enlarged. *Pinnixa barnharti* and members of the genus *Holothuriophilus* share a carapace broader anteriorly, chelipeds large and robust, and walking legs short and wide. They differ in their MXP3 morphology. In *P. barnharti* the exopod has an external lobe, and the endopod has a carpus shorter than the spatulated propodus (Fig. 1B). In *Holothuriophilus* the exopod lacks an external lobe, and the endopod has a carpus larger than the conical propodus (Fig. 1E).

The southern distribution of *P. barnharti* Rathbun, 1918 is found to be restricted to Punta Banda estuary, Todos Santos Bay, BC, Mexico. This crab seems to occur only in the cloaca of the holothurid *Caudina arenicola* (Stimpson).

Pinnixa richardsoni Glassell, 1936
Fig. 4A–B

Pinnixa richardsoni Glassell, 1936:301–302, pl. 21, fig. 3; Wicksten, 1982:356–357, Fig. 2; Hendrickx, 1995:141 (listed).

Previous distribution.—Balboa, Canal Zone, Panama (type locality).

Material examined.—4 males, 2 females, Laguna Superior, inlet front to Santa Maria Xadani, Juchitan de Zaragoza, Oaxaca, 17 Nov 1994; mud bottom, 1.6 m.

Remarks.—The morphology of our specimens agrees with the original description of *P. richardsoni* provided by Glassell (1936). He noted that the male in this species has the abdominal somites 3–5 fused. Wicksten's (1982) statement that abdominal somites 1–3 are fused in this species is incorrect. According to Glassell (1936), *P. richardsoni* is very closely allied to *P. valerii* Rathbun, 1931. This is widely supported by the very similar shape of MXP3 and abdomen in these species (Fig. 4A–D). Wicksten pointed out that *P. valerii* can be separated from *P. richardsoni* by the presence of six free abdominal somites and telson in the former. One of us (EC) examined two male specimens of *P. valerii* (UABC) and although a demarcation line is faintly indicated, somites 3–5 are clearly fused and the arthrodial membrane is absent (Fig. 4D). Michel Hendrickx, on our request, examined the male specimen of *P. valerii* (EMU 646) from El Verde, Sinaloa, Mexico on which Wicksten (1982) based her report. Hendrickx observed that *Pinnixa richardsoni* also has a demarcation line among the fused abdominal somites 3–5 (Fig. 4B). However, morphological differences between these species do exist, including shape and robustness of WL and shape of sixth abdominal somite. Wicksten (1982), who studied the holotype of both species, pointed out that the legs of *P. richardsoni* are stouter than those of *P. valerii.* She noted that the former species has the merus of WL3 1.9 times as long as wide; in *P. valerii* it is 2.7 times as long as wide. Regarding the sixth abdominal somite, *P. richardsoni* has the distal margin concave; in *P. valerii* it is straight (Fig. 4B, D).

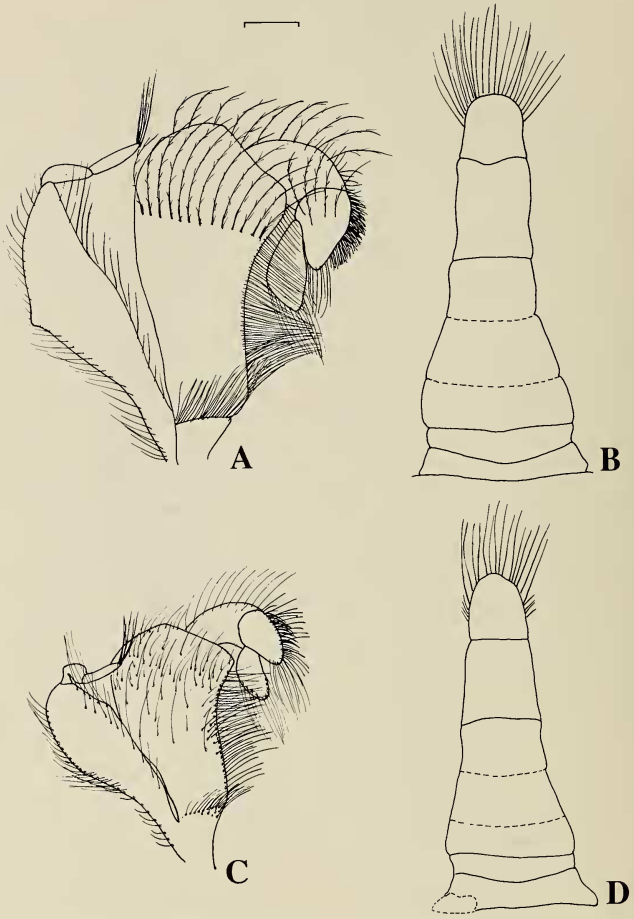

Fig. 4. *Pinnixa richardsoni* Glassell, 1936: A, third maxilliped; B, abdomen. *P. valerii:* C, third maxilliped; D, abdomen. Scale (mm): A = 0.3; B = 1.26; C = 0.36; D = 0.83.

Pinnixa scamit Martin & Zmarzly, 1994
Fig. 5A–C

Pinnixa scamit Martin & Zmarzly, 1994: 354–359, Figs. 1, 2.

Previous known distribution.—Western Santa Barbara Channel, just seaward of,

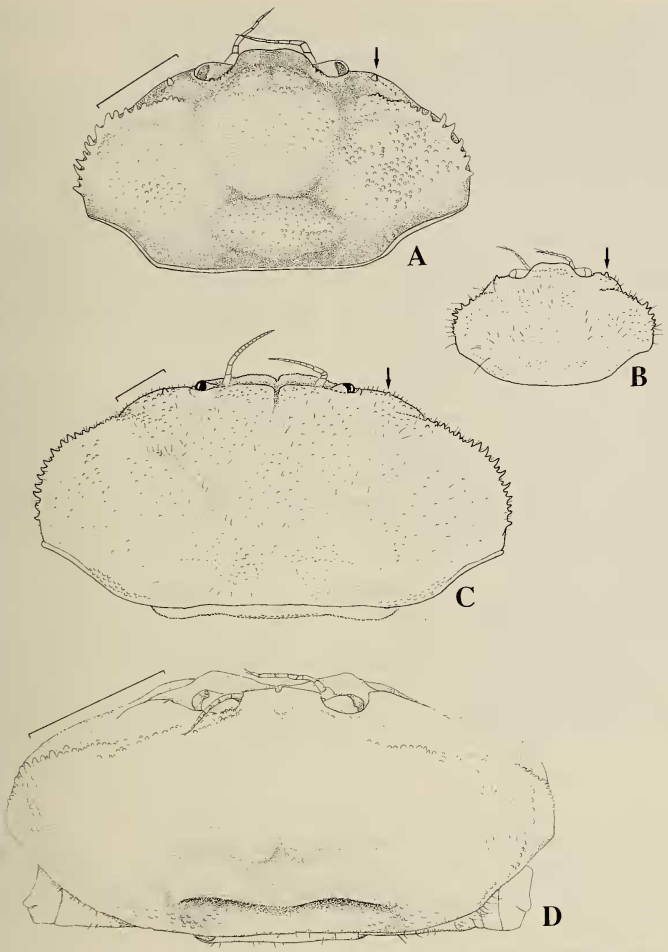

Fig. 5. *Pinnixa scamit* Martin & Zmarzly, 1994: anterodorsal view of carapace, A, male; B, juvenile (sex indetermined). *P. occidentalis* Rathbun, 1893: C, female; D, male juvenile, anterodorsal view of carapace. Arrows indicate the subhepatic tooth. Scale = 1 mm (B–C from Martin & Zmarzly 1994; D, from Zmarzly 1992).

and SSW of, Pt. Arguello, California, 34°29.04'N, 120°44.01'W.

Material examined.—2 males, 2 females, all lacking pereiopods, Todos Santos Bay, Ensenada, BC, Mexico (UABC); dredge, slime-clay bottom, 27–48 m.

Remarks.—Bonfil et al. (1992) and Zmarzly (1992) recorded eight species of the genus *Pinnixa* for the west coast of BC. *Pinnixa scamit* Martin & Zmarzly, 1994, a species morphologically close to *P. occidentalis* Rathbun, 1893, is the ninth newly recorded *Pinnixa* species in Mexico. Although our male (previously unknown) and female specimens lack WL, we assigned them to *P. scamit* by the presence of several morphological features: a well developed, granular, cardiac ridge on the carapace; larger, acute, slightly curved teeth along the anterolateral margin of the carapace; and a well-developed subhepatic tooth (Fig. 2A–C). Males and females of *Pinnixa occidentalis* have: an acute, sometimes bilobate cardiac ridge; anterolateral margin with a granulated ridge; and no trace of a subhepatic tooth (Fig. 2D).

Although the host of *Pinnixa scamit* remains unknown, specimens of polychaete worms belonging to 20–28 families co-occurred in the dredges. Members of Spionidae, Cirratulidae and Paraionidae were the most abundant. They remain as potential hosts for this crab (Table 1).

Table 1.—Common polychaete worms dredged with the crab *Pinnixa scamit* at Todos Santos Bay, Ensenada, Baja California, Mexico.

Family	Species*
Cirratulidae	*Cauperiella alata* Southern
	Monicellina tesselata Hartman
Paraonidae	*Aricidea wassi* Pettibone
	Cirrophours sp.
	Allia ramoso Annenkova
Spionidae	*Laonice cirrata* Sars
	Paraprionospio pinnata Ehlers
	Spiophanes bombyx Claparede

* Deposited in the Invertebrate Collection (Marine Ecology Department) of Centro de Investigación Científica y de Educación Superior de Ensenada, Ensenada, Bc, México.

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